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Effects of Social Security Reforms: An Empirical Life Cycle Model for the United States

Abstract
[Excerpt] The system of publicly-provided old age pensions, known in the United States as "Social Security," faces serious financial difficulties. As in other countries, the problems are of both a short run and a long run nature. The short run problem is that the U.S. Social Security system has very meager financial reserves; the revenues coming into the system are barely enough to cover commitments. In the long run (i.e., after 2010, when the post World War II baby boom generation reaches retirement age), the financial problems of Social Security will intensify, due primarily to population aging and the consequent decline in the ratio of workers to retirees. For an elaboration of these problems, see Thompson, 1983.

These problems have led to proposed reforms aimed at assuring the financial stability of the systems. The question addressed here is: what effects will these reforms have on three variables - retirement ages, retirement incomes, and the Social Security system. This paper presents estimates of the effects of four actual or proposed policy changes. The basic model and some of the estimated effects are drawn from previous work; see Fields and Mitchell (1984) and the references cited therein. However, the estimates presented here of the effects of Social Security reforms on the Social Security system itself are new.

Keywords
Social Security, aging, pension, retirement

Comments

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EFFECTS OF SOCIAL SECURITY REFORMS: AN EMPIRICAL LIFE CYCLE MODEL FOR THE UNITED STATES *

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I. INTRODUCTION

The system of publicly-provided old age pensions, known in the United States as "Social Security," faces serious financial difficulties. As in other countries, the problems are of both a short run and a long run nature. The short run problem is that the U.S. Social Security system has very meager financial reserves; the revenues coming into the system are barely enough to cover commitments. In the long run (i.e., after 2010, when the post World War II baby boom generation reaches retirement age), the financial problems of Social Security will intensify, due primarily to population aging and the consequent decline in the ratio of workers to retirees. For an elaboration of these problems, see Thompson, 1983.

These problems have led to proposed reforms aimed at assuring the financial stability of the systems. The question addressed here is: what effects will these reforms have on three variables - retirement ages, retirement incomes, and the Social Security system. This paper presents estimates of the effects of four actual or proposed policy changes. The basic model and some of the estimated effects are drawn from previous work; see Fields and Mitchell (1984) and the references cited therein. However, the estimates presented here of the effects of Social Security reforms on the Social Security system itself are new.

II. THE LIFE CYCLE FRAMEWORK

The basic analytical framework is the economist's model of life cycle decision-making. This model maintains that intertemporal choices are made

* Research support was provided by the National Commission for Employment Policy. All opinions are the authors'.

with reference to intertemporal preferences and an intertemporal budget set. Perhaps the most familiar application is to educational decision-making, wherein the individual is thought to decide how much schooling to acquire on the basis of his or her preferences and the income and job opportunities associated with alternate educational attainments. As regards retirement, although the first round empirical models were limited to a single period only (e.g., Quinn, 1977; Boskin and Hurd, 1978; Clark and Johnson, 1980), the retirement decision is today regarded in life cycle terms.[1] That is, the individual is viewed as deciding how long to work and when to retire on the basis of the income from various sources that would be realized at alternate retirement ages and the associated amounts of leisure.[2]

Figure 1 depicts graphically the life cycle retirement model. The horizontal axis measures RET, the length of the expected retirement period from any given retirement age R until the end of the individual's expected lifetime. The vertical axis measures PDVY, the present discounted value of expected lifetime income over the remainder of one's lifetime for an individual who retires at age R . PDVY is the sum of earnings until retirement plus employer-provided pension and Social Security benefits thereafter, all appropriately discounted for time preference and for mortality. The intertemporal budget set, shown as AA' in Figure 1, represents the possible combinations of income and retirement years. As shown in the figure, PDVY increases as RET decreases, reflecting the fact that for the average worker, an additional year of work generates earnings and pension accruals which exceed the retirement income foregone. Indifferences curves are drawn as in BB', reflecting the usual assumptions about income and leisure being goods and the utility function being increasing and concave in both goods. Given budget set AA' and indifference curves like BB', the optimal retirement age is R* - that which maximizes intertemporal utility subject to the intertemporal budget set.

To estimate how Social Security and other income sources affect workers' choices of retirement ages, information is required on the actual retirement age chosen and the intertemporal budget set facing each worker. We constructed the necessary data for a sample of 1,024 white males covered by the Longitudinal Retirement History Survey for the years 1969 through 1977. To these data, we fit an Ordered Logit model of a type suggested by McFadden (1974, 1978) and Small (1981, 1982). The probability of selecting retirement age j from among several ordered alternatives is described as:

1 Says Quinn (forthcoming), who formulated one of the earlier models: "Until relatively recently, analysis tended to describe the magnitude of retirement income rights by the size of the annual benefit, or by its close relative, the replacement rate. Though useful summary statistics, these annual flow concepts ignore key aspects of the retirement incentives: in particular, how annual benefits change with continued work or with inflation after retirement."

2 Some might question whether retirement is a choice at all or whether it is compelled by poor health or mandatory retirement. The U.S. evidence shows that the great majority of workers could go on working (i.e., their health is sound and they have not yet reached the age of mandatory retirement in their firms) but elect to retire earlier, presumably to enjoy more leisure. See Fields and Mitchell, (1984), for a summary of this literature.

$$p_j = \frac{\exp(a \ln PDVY_j + b \ln RET_j + N_j)}{\sum_k \exp(a \ln PDVY_k + b \ln RET_k + N_k)} \quad (1)$$

where

$$N_k = 1/2 \; [\ln (1/2) + \ln (1 + P^0_{j-1}/P^0_j) + \ln (1 + P^0_{j+1}/P^0_j)]$$

and P^0_k is the probability of selecting retirement age k in a conventional multinomial logit model.

Social Security reforms alter the streams of available Social Security benefits and hence the PDVY streams as well. The post-reform budget sets are then substituted into the Ordered Logit model. Predictions from the new and old budget sets may then be compared. The difference between the two is the change in retirement age predicted from the Social Security reform in question. Changes in retirement incomes are found by comparing incomes under the new rules with incomes under the old, taking account of changes in retirement ages which result from the rule changes. The effects of Social Security reforms on the Social Security system are found by looking at changes in Social Security benefits paid out and Social Security payroll taxes received.

III. EMPIRICAL ESTIMATES OF THE EFFECTS OF FOUR SOCIAL SECURITY REFORMS PRELIMINARIES

The first step is to estimate the intertemporal budget set under the existing rules. The first three rows of Table 1 present the annual amounts for

TABLE 1

Components of the 1982 pre-reform budget set for the LRHS illustrative worker [a]
(in 1982 dollars)

	If retirement is at age:								
Annual amounts:	60	61	62	63	64	65	66	67	68
1. Net earnings	$ 16424	16265	16330	16012	15882	15952	15877	15845	15752
2. Net private pension benefits	837	962	1356	1875	1817	1896	2128	2129	2069
3. Social security benefit: Husband	5378	5401	5456	5964	6481	7017	7307	7605	7610
Wife	2449	2579	2636	2720	2823	2948	3069	3190	3301
Present discounted values:									
4. PDVE	0	15793	30803	45238	58770	71580	83836	95432	106406
5. PDVPP	4272	4697	6115	8318	7657	7573	8036	7575	6914
6. PDVSS: Husband	67402	67697	68387	69242	69515	69341	66311	63173	59928
Wife	25126	25245	25482	25696	25836	25819	25429	24782	23842
Total lifetime income: [b]									
[PDVY=(4)+(5)+(6)]	96800	113433	130988	148495	161790	174315	183613	190963	197092

[a] Computations use 1982 Social Security rules; see text.

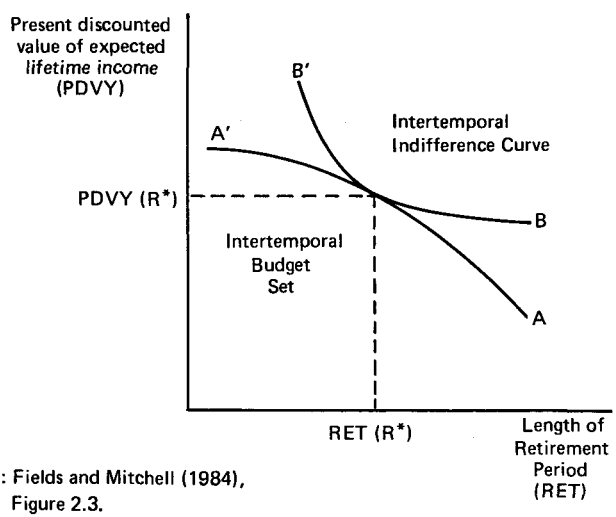
[b] Totals may differ from column sums due to rounding.

Source:
Fields and Mitchell (1984), Table 10.1.

each component, the next three rows the corresponding present discounted values of the components, and the last row the present discounted value of total income. Space does not permit further elaboration; details are available from the authors upon request.

The next step is to determine the parameters of the Ordered Logit model indicating how these income opportunities and the corresponding amount of leisure affect retirement behavior. Both income and leisure are found to exhibit statistically significant effects. The ratio a/b in equation (1) is estimated to be 0.60. Furthermore, using a test suggested by Hausman and McFadden (1981), the Ordered Logit framework is found to fit the data better than does the more restrictive Multinomial Logit model.

The third step is to detail the various Social Security reforms under consideration and to compare them with the pre-reform rules.[3] To be eligible for any Social Security benefit at all, the worker must have earned at least a certain minimum sum in the past. If he meets this requirement, he can collect Social Security benefits as early as age 62, though age 65 is the "normal" retirement age. The amount of his benefit is determined in three steps: (1) Finding his Average Indexed Monthly Earnings (AIME) between 1951 and the year in which he turns 60; (2) Determining his Primary Insurance Amount (PIA) as a function of his AIME; and (3) Computing his Social Security benefit as a multiple of his PIA. At present, the multiple is 1.00 if the worker is age 65 when he begins to collect benefits. An early retirement reduction factor of 6 2/3 % per year is applied for each year before age 65 if benefits are taken early, and a delayed retirement credit of 3 % per year is awarded to workers waiting until after age 65 to retire. Finally, spouse's benefits, if any, must be added. The wife is eligible to receive benefits based on her husband's PIA. If she is 65, she receives a benefit equal to 50 % of his PIA. If she is 62 or over but not yet 65, she may receive a reduced benefit; the reduction is at the rate



Source: Fields and Mitchell (1984), Figure 2.3.

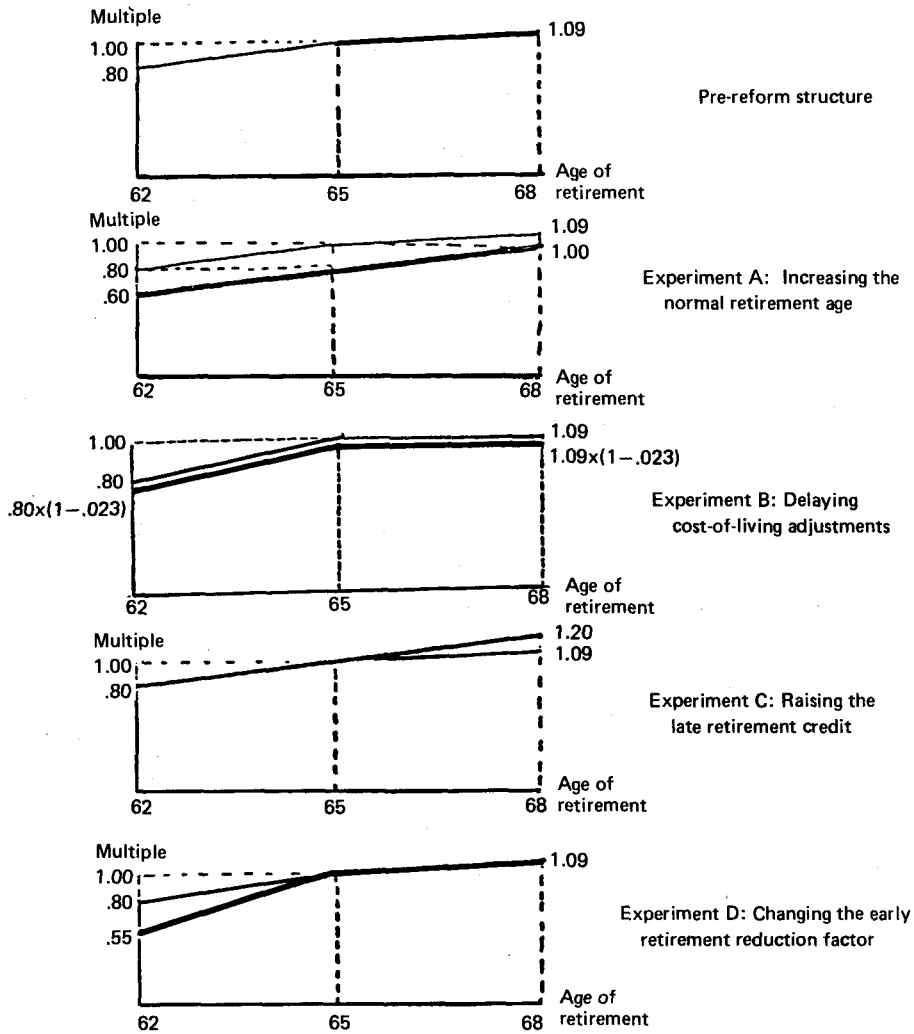
Figure 1

A graphical representation of the life cycle retirement model

[3] For this purpose, the 1982 rules are used.

of 8 1/3 % per year. There is no delayed retirement credit for spouse's benefits. Benefits for both the worker and the spouse are increased each year in accordance with inflation.

As shown in Figure 2, the Social Security reforms examined here operate by affecting the multiples. The pre-reform rules are depicted in the top panel and



Source: Fields and Mitchell (1984), Figure 10.1.

Figure 2

Restructuring social security benefits: four experiments

are redrawn as lighter lines in each of the remaining panels. The reforms appear as heavier lines in panels A-D.

Four reforms, similar to ones actually legislated in 1983 or proposed for legislation, can now be described:

Experiment A. Increasing the normal retirement age means that a worker who retires at age 65 no longer receives a benefit equal to his PIA. Experiment A simulates the effect of raising this age to age 68, as was widely proposed. (What in fact was legislated was a change to age 66 by the year 2009 and to age 67 by the year 2027). Under the simualted reform, the multiple becomes 1.00 at age 68 and the early retirement reduction factor remains at 6 2/3 % per year. Thus, the multiples under this experiment are .60 for retirement age 62 and .80 for retirement age age 65, with corresponding reductions at other ages. (The 1983 legislation set a minimum multiple of 70 %).

Experiment B. Delaying the cost-of-living adjustment

Rule in effect in 1982 specified that cost-of-living adjustment would take place each July, reflecting increases in the Consumer Price Index during the preceding calendar year. The 1983 legislation amendments delayed these increases by an additional six months. This six months delay reduces real benefits by half the rate of inflation, or 2.3 %.

Experiment C. Raising the late retirement credit means that benefits are increased faster than 3 % if retirement is postponed beyond age 65. We simulated a 6 2/3 % per year late retirement credit, the same as the early retirement reduction factor. The multiple for retirement at age 68 would have risen from 1.09 to 1.20. (As it turned out, in 1983), Congress mandated a gradual increase in the late retirement credit, eventually reaching 8 % per year as of the year 2009).

Effects on the Intertemporal Budget Set

The effects of these reforms on the annual and lifetime streams of Social Security benefits appear in Table 2; effects on total income from earnings, employer-provided pensions, and Social Security combined appear in Table 3. These calculations are for an illustrative worker whose earnings history corresponds to that of the average male in our LRHS Sample. Compared to the existing system all reforms imply benefit cuts but the amounts and shapes of the cuts differ from one reform to another.

Increasing the normal retirement age to 68 (Experiment A) lowers retirement benefits by more than $1,000 per year, or about $17,000 for people retiring in their early 60's; the reduction is almost as large for workers deferring retirement until age 65. Another effect of Experiment A is to tilt the Social Security benefit structure toward actuarial neutrality, in stark contrast to the pre-reform situation which contained a penalty for continuing to work. Thus, increasing the normal retirement age as outlined here lowers benefits at any given retirement age and provides new financial incentives to remain on the job longer.

Experiment B, in which the cost-of-living adjustment is postponed six months, has a relatively small effect. Annual benefits are reduced by $100-200,

TABLE 2

Effects of the four experiments on annual and present discounted values of social security benefits for the illustrative worker [a] (in 1982 dollars)

	Retirement age								
Annual SS benefits:	60 [b]	61 [b]	62	63	64	65	66	67	68
Status quo	5378	5401	5456	5964	6481	7017	7307	7605	7910
Experiment A	4034	4052	4093	4588	5092	5614	6148	6696	7256
Experiment B	5255	5278	5331	5827	6332	6856	7139	7430	7728
Experiment C	5378	5401	5456	5964	6481	7017	7567	8131	8707
Experiment D	3698	3714	3752	4818	5903	7017	7307	7605	7910
PDV of SS benefits									
Status quo	67402	67697	68387	69242	69515	69341	66311	63173	59928
Experiment A	50566	50783	51300	53275	54624	55474	55798	55621	54974
Experiment B	65852	66140	66814	67649	67916	67746	64786	61720	58550
Experiment C	67402	67697	68387	69242	69515	69342	68674	67540	65969
Experiment D	46352	46551	47025	55936	63316	69342	66311	63173	59928

[a] The figures reported in this table are husbands' benefits. Wives' benefits remain constant, since they are calculated from their husband's PIA, which does not change in these experiments.

[b] These are the benefits the illustrative individual would receive if he filed for benefits at age 62 but retired at the age indicated.

Source:
Fields and Mitchell (1984), Table 10.2.

TABLE 3

Effects of the four experiments on the present value of total lifetime income

	Age of retirement:								
	60	61	62	63	64	65	66	67	68
Current system:	96801	113433	130988	148495	161780	174315	183613	190963	197092
Experiment A: Increasing the normal retirement age	77964	96519	113900	132528	146888	160447	173100	183411	192138
Experiment B: Delaying cost-of-living adjustments	95251	111870	129415	146902	160181	172720	182088	189510	195714
Experiment C: Raising the late retirement credit	96801	113433	130988	148495	161780	174315	185976	195330	203132
Experiment D: Changing the early retirement reduction factor	75750	92287	109625	135189	155580	174315	183613	190963	197092

Source:
Fields and Mitchell (1984), Table 10.3.

which translates into diminished present discounted values of at most $1,600. Since the income amounts involved are small, this reform does not appreciably alter the pattern of discounted benefit gains obtained by deferring retirement.

Experiment C raises the late retirement credit to match the early retirement reduction factor. Benefits are increased after age 65, raising annual benefits by as much as $800 at age 68. Present value at age 68 increses by $6, 000 - still not enough to achieve actuarial neutrality, but substantially reducing the penalty (in PDV terms) for continuing to work beyond age 65.

Experiment D lowers early Social Security benefits, holding benefits beyond age 65 the same. For a worker retiring at age 62 or before, the annual benefit would have fallen by $1,700 and present discounted value by some $21, 000. The gain in present discounted value of Social Security benefits for an extra year of work before age 65 would have been $6,000-9,000. This reform would have created a powerful penalty for retiring early and a powerful incentive for continued work. Yet, as we shall see, even those forces would not change retirement ages very much.

Effects on Retirement Ages

Column 1 of Table 4 presents the changes in retirement ages predicted for each of the four reforms. The largest effect is that found under Experiment D, which cuts benefits at the earliest retirement age while offering a larger reward for continued work after age 62. Workers would retire about three months later, on average, as a result of this reform. Intermediate retirement responses are found under Experiment A, which changes the normal retirement age. Benefits are lowered by approximately the same dollar amount at every age but the gain from working an additional year is unchanged. This is predicted to delay retirement by about one and half months, on average. The smallest responses occur when early retirement benefits are altered the least. Both Experiment B (delaying cost-of-living adjustments) and Experiment C (raising the late retirement credit) are of this type. These reforms are predicted to delay retirement by an average of less than one week each.

All in all, the results suggest that workers will work longer if Social Security benefits are cut, but not too much. This generic conclusion is consistent with estimates obtained by others using different models and simulating different reforms. Burtless and Moffitt (1984) estimate that a ten percent change in Social Security benefits would affects retirement ages by about one month. Hausman and Wise (1983) calculate that if instead of the actual 50 % increase in PIA that took place between 1969 and 1975, PIAs had remained the same, only 3 % fewer people would have retired at age 65 and 4 % fewer at age 66. Gustman and Steinmeier (1983) predict that a two-year increase in the normal retirement age would increase the average retirement age by about two months and that a six month cost of living deferral would raise the average retirement age by less than one month.

In sum, the various research findings are strikingly similar in suggesting substantial Social Security reforms of the type considered here have only small effects on the average age of retirement.[4]

[4] We suspect that the only way to greatly increase retirement ages is to raise the age for *early* Social Security benefits, but this suspicion cannot be tested with the available models.

TABLE 4

Effects of the four experiments on retirement ages, present discounted values of social security benefits (PDVSS) and total lifetime income (PDVY), and the financial status of the social security system

	(1) Change in retirement age in months (ΔR)	(2) % Δ PDVSS with retirement age endogenous	(3) % Δ PDVY with retirement age age endogenous	Savings to the Social Security System (4) Due to increased contributions	(5) Due to decreased payouts	(6) Total, (4) + (5)
Experiment A: Increasing the normal retirement age	+ 1.6	− 22 %	− 9 %	+$355	+$15,167	+$15,522
Experiment B: Delaying cost-of-living adjustments	+ 0.1	− 2 %	− 1 %	+ 27	+ 1,593	+ 1,620
Experiment C: Raising the late retirement credit	+ 0.2	0	0	+ 55	− 6	+ 54
Experiment D: Changing the early retirement reduction factor	+ 2.9	− 11 %	− 3 %	+ 655	+ 7,412	+ 8,067

Sources:
Columns 1, 2, and 3 — Fields and Mitchell (1984), Table 10.4; Columns 4, 5, and 6 calculated as in text.

Effects on Retirement Incomes

Whether Social Security reforms affect retirement incomes, and if so by how much, depends on the extent of the shift in the benefit schedule (lower benefits at each retirement age) compared to the extent of movement along the new schedule (higher benefits due to deferred retirement). Some may have throught that in response to a lower benefit schedule, workers would postpone retirement by enough to keep their retirement incomes unchanged. However, the small changes in retirement ages found in Column 1 unchanged. However, the small changes in retirement ages found in Column 1 suggest otherwise. Indeed, as shown in Column 2, the reforms would cut the Social Security benefits received, even after taking account of the lengthened worklife and consequent increase in annual Social Security benefits. These cuts are as large as 22 % under Experiment A, which increases the normal retirement age. The effects are largest under this experiment than under the others, because it reduces early retirement benefits a great deal while retaining a small incentive for prolonged work. Even though retirement is deferred somewhat, increased employer-provided pensions and earnings do not make up the difference. As shown in Column 3, after taking account of postponed retirement on earnings, pension, and Social Security, the effect of the Social Security reforms is still to lower retirement incomes - by as much as 9 % in the case of Experiment A. Thus, because retirement ages are not very elastic with respect to changes in the Social Security benefit structure, retirement incomes would be expected to fall.

Effects on the Social Security System

The Social Security system's financial problems are alleviated under the various reforms to the extent that either of two things happens: (1) Workers work longer, so they and their employers contributing on their behalf each pay more into the Social Security system, and/or (2) Retirees receive less in total benefits from the system. The increased contribution effect is found by multiplying the average deferral of retirement by the average gross earnings in each year, and then applying the combined employer/employee contribution rate to the result (6.7 % for each in 1982, the year for which these calculations were made). Savings to the system due to increased contributions appear in Column 4 of Table 4. The savings to the Social Security system from lower benefit payouts is simply the mirror image of the loss to workers in present discounted value of Social Security benefits. This is found by comparing the benefit at the average retirement age under the pre-reform formula with the benefit at the new retirement age under the experimental formula. Savings to the system due to decreased payouts appear in Column 5. Total savings are shown in Column 6.

In each case, the Social Security system comes out ahead: by more than $15,000 in the case of Experiment A (increasing the normal retirement age) and by more than $8, 000 for Experiment D (changing the early retirement reduction factor). Given that there are millions of Social Security recipients, the system would gain many billions of dollars if these reforms were implemented. For example, if 20 million workers (the number now receiving Social Security benefits) were each to receive £15,000 less on balance in the course of their lifetimes, the system would gain some £300 *billion*. This surpasses by more than $100 billion the Social Security deficit that was viewed as unacceptable and which prompted the Social Security amendments of 1983. Yet, even this huge sum would go only a small part of the way toward meeting the multi-*trillion* dollar long term deficit of the system.

Of course, the gains for the system are to a large degree losses for retirees, since extra earnings and employer-provided pensions would go only part of the way toward filling the gap created by less generous Social Security benefits. Those who thought that the U.S. Social Security system could be saved at the expense of workers' leisure but not their old age incomes appear to have been sadly mistaken.

IV. A CONCLUDING WORD

Difficult societal decisions will have to be made to deal with the two central demographic changes of the Twenty-First Century: the arrival of the postwar baby boom cohort at retirement age and the projected continued lengthening of the life span. In the absence of change, future generations will be asked to maintain annual retirement incomes at their present real levels while also increasing the number of retirement years. Social Security is financed on a pay-as-you-go basis, so the workers of the future will face the costs directly. It seems unlikely that they will pay them without protest. It remains to be seen which will give - income per year of retirement, number of retirement years, or both - and by how much. But to expect nothing to give is to ignore the intergenerational tension which already is surfacing.

SUMMARY

The U.S. Social Security system faces financial peril in both the short and long runs due in part to population aging. Various reforms have been proposed to help assure the system's financial solvency. This paper examines the effects of four such reforms, including increasing the normal retirement age, delaying cost-of-living adjustments, raising the late retirement credit, and changing the early retirement reduction factor. Increasing the normal retirement age is estimated to have the largest effect on actual retirement ages, but even this effect is only on the order of three months; other experiments change average retirement behavior by even less. Because reductions in Social Security benefit formulas lead to small retirement deferrals, the reforms would cause retirement incomes to fall by as much as 9 %. The reforms might save the Social Security system as much as $15,000 in lifetime benefits paid out to the average worker. For the most part, though, the system's gains are workers' losses. Older persons apparently will not give up much leisure in order to qualify for higher retirement incomes.

RESUME

EFFETS DES REFORMES DE LA SECURITE SOCIALE: UN MODELE EMPIRIQUE BASE SUR LES PERIODES DE LA VIE APPLIQUE AUX ETATS-UNIS

Le fonctionnement du système de sécurité sociale des Etats-Unis est à court et à long terme mis en danger sur la plan financier. Ce péril vient en partie du vieillissement de la population. Diverses réformes ont été proposées en vue d'assurer la solvabilité du système. Dans cette communication, l'auteur examine les effets de quatre de ces réformes, à savoir: l'élévation de l'âge normal de la retraite, la post-position des ajustements au coût de la vie, l'augmentation du crédit en cas de retraite tardive, et la modification du coefficient de réduction lié à la retraite anticipée.

C'est l'élévation de l'âge normal de la retraite qui semble avoir le plus large effet sur les âges réels de celle-ci, même si cet effet est estimé être de l'ordre de seulement trois mois. Les autres facteurs modifient encore moins l'âge moyen de la retraite.

Etant donné que les formules de réduction des indemnités de la sécurité sociale ne produisent que de faibles post-positions du retrait de la vie active, il faudrait que les réformes introduites provoquent une baisse égale à 9 % des revenus des retraités. Ces réformes permettraient au système de sécurité sociale d'économiser 15.000 dollars sur les indemnités versées au cours de la vie du travailleur moyen. Dans leur majeure partie donc, les gains pour le système représentent des pertes pour les travailleurs. Les personnes plus âgées ne se donneront apparemment pas beaucoup de peine pour obtenir des revenus plus élevés lors de leur retraite.

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